Appended Form 1

Specifications for Major Program

Name of School (Program)〔School of Engineering Cluster 3 (Applied Chemistry, Biotechnology and Chemical Engineering)〕

Program name (Japanese)	生物工学プログラム
(English)	Program of Biotechnology

1. Academic Degree to be Acquired

Bachelor's degree in engineering

2. Overview

In order to contribute to the advancement of the key industries that will play a role in the next generation, such as medicine, food, and environment, this program aims at developing engineers and researchers that possess professional expertise and technical skills in the elucidation and utilization of biological molecules and living organisms. Therefore, this program establishes a curriculum through which students can organically and systematically acquire comprehensive knowledge of the basic mechanisms of life and technical skills in the most-advanced fields, such as gene, protein, carbohydrate, and lipid engineering; microorganism, animal, and plant engineering; biochemical engineering; bioinformatics engineering; environmental biotechnology; immunology; and brewing technology. Students can also acquire the different abilities required for researchers and engineers, such as the ability to think logically, the ability to plan and conduct experiments, the ability to explain data analysis, the ability to discover and resolve the problems, and the ability to deal with practical issues. This program awards the Type-1 High School Teaching License (Industry) to students who have taken the required courses. Graduates gain employment and work actively for corporations in the pharmaceutical, food, brewing, environmental, and chemical industries, or in public research institutions. Graduates can go to graduate school (Graduate School of Integrated Sciences for Life) to obtain a higher degree of education and undertake research.

3. Academic Awards Policy (Policy for awarding degrees and goal of the program)

The Program of Biotechnology　nurtures professionals that have acquired the basic knowledge, skills, and attitudes needed to work as bioengineering researchers and engineers and, further, to embrace opportunities for creativity in scientific thought.

Therefore, this program offers education aimed at cultivating a broad range of general knowledge, a global perspective to seek peace, a general sense of judgment, and a well-rounded character. The program awards a bachelor's degree in engineering to students who have completed sufficient liberal arts education and specialized education to achieve the following goals from (A) to (E), as well as the number of credits necessary to meet the standard of the course.

(A) The ability to understand the relationship between people, society, nature, and engineering, and to demonstrate multifaceted and logical thinking skills

(B) The ability to understand basic natural science

(C) The ability to acquire basic knowledge of biotechnology and biological science, and to expand it widely to applied technology

(D) The ability to come up with conceptual ideas and to implement ideas, as well as the ability to transmit learning and research results

(E) The ability to adapt to the highly sophisticated information society with high level communication skills

4. Curriculum Policy (Policy for Preparing and Implementing the Curriculum)

through mastery of “Group Discussion of Current Biotechnology Topics” to be offered in the third year and “Graduation Thesis” to be offered in the fourth year.

・The ability to organize research results and write logically, including about the significance and validity of the obtained outcome, and to prepare presentation data, present it, and discuss it verbally in an easy-to-understand manner (Goal E). These are obtained through mastery of “Group Discussion of Current Biotechnology Topics” to be offered in the third year, and “Graduation Thesis” to be offered in the fourth year.

・Teamwork ability, leadership ability, and communication ability in group work (Goal E). These are obtained through mastery of “Basic Experiments in Chemistry”, and “Training of Biotechnology I・II” to be offered from the third and fourth term of the second year though the third year, and through “Group Discussion of Current Biotechnology Topics” to be offered in the third year.

・The ability to read, write, and converse in the English language necessary for conducting research (Goal E). This is obtained through mastery of “Communication Basic・I・II” in the liberal arts education subjects, “Technical English” to be offered in the third and the fourth terms of the second year, and “Graduation Thesis“ to be offered in the fourth year.

5. Program Timing and Acceptance Conditions

・When to start the program:

The second semester of the second year

Cluster 3 offers distinctive education that organically integrates fields related to chemistry, biotechnology, and processes. Specifically, it aims at developing professionals that possess a wide range of basic knowledge about the development of new functional substances and materials, the biotechnology of plants, animals, and microbes, the design and control of chemical process, environmental preservation and bioremediation, and the development of resources and energy, as well as having a high level of expertise and technical skill in a harmonious way. To achieve this aim, in addition to the common subjects and a wide range of specialized basic education, three programs are prepared that provide specialized education about chemistry, biotechnology and processes. These are the Program of Applied Chemistry, the Program of Biotechnology, and the Program of Chemical Engineering. Registration to these three programs is to be made in the second semester of the second year, so that students are able to choose the suitable specialized field or program while acquiring a wide range of specialized basic knowledge.

・Requirements of Acquired Credits

In order to be assigned to each program, students must acquire 16 or more credits out of a total of 18 credits in compulsory specialized basic subjects (excluding Basic Chemical Experiment and Technical English) and must acquire an overall total of 60 or more credits (including in liberal arts education subjects).

・Program Quota

An upper limit is set for acceptance of students. Assignment to the Program of Applied Chemistry, the Program of Biotechnology and the Program of Chemical Engineering is decided after taking into account the requests of students and their academic results.

6. Qualifications to be Acquired

・Type-1 High School Teaching License (Industry) (By mastering “Vocational Guidance”, the prescribed “liberal arts education subjects” and “specialized education subjects”, students can obtain the Type-1 High School Teaching License (Industry) upon graduation.)

Details are described in the student handbook and guidance materials.

7. Class Subjects and Course Content

* For class subjects, see the subject list in the attached Tables 1 and 2.

(Subject list to be attached.)

8. Academic Achievements

At the end of each semester, evaluation criteria are applied to each evaluation item and indicate academic achievement by indicating the attainment level. Students' grade calculations for each subject, from admission to the university until the current semester, is given as one of the three levels: "Excellent," "Very Good," and "Good," based on evaluation criteria calculated by adding the weighted values to the numerically-converted values of their academic achievements (S = 4, A = 3, B = 2, and C= 1) in each subject being evaluated.

Result Evaluation	Conversion
S（90 points or more）	4
A（80 ~ 89 points）	3
B（70 ~ 79 points）	2
C（60 ~ 69 points）	1

Academic Results	Standard
Excellent	3.00 ~ 4.00
Very Good	2.00 ~ 2.99
Good	1.00 ~ 1.99

* See the relationship between evaluation items and evaluation criteria in the attached sheet 2.
* See the relationship between evaluation items and class subjects in the attached sheet 3.
* See the curriculum map in the attached sheet 4.

9. Graduation Thesis (Graduation Research) (Positioning, when and how it is assigned, etc.)

Students receive practical guidance through graduation work in a research laboratory where world-leading research is conducted in various fields of biotechnology, and acquire a fundamental capability as bioengineering researchers and engineers.

Students are to be assigned at the start of the fourth year. As requirements for undertaking a graduation thesis, students must acquire 8 credits in foreign languages and must have completed all experiment subjects and practical subjects to be taken. Furthermore, students must acquire a total of 115 or more credits (including liberal arts education subjects) including a total of 69 or more credits in specialized basic subjects and specialized subjects. (Refer to the attached Table 1 and Table 2)

10. Responsibility System

(1) PDCA Responsibility System ("Plan," "Do," "Check," and "Act")

The Educational Evaluation Committee (in charge of examining and handling the faculties' evaluation of the curriculum and the content of lectures), The Student Evaluation Committee (in charge of examining and handling evaluation of the students, such as attainment levels against goals), and the Educational Improvement Committee (in charge of planning and handling curricula based on self-assessment and questionnaires) are set up within the committee for this program (see the attached sheet 54). Under the leadership and responsibility of the head of the program, all the teachers of this program work together in cooperation with each other to carry out the system.

(2) Program Assessment

・Criteria for program assessment:

Evaluation outcome of attainment levels against goals

Requests from students and demands of society

Evaluation outcome of self-assessment by faculties

・Method of assessment (connection with class evaluation to be described)

In addition to attainment levels evaluation summary sheet completed by the Education and Student Evaluation Committee, questionnaires by students and graduates, and self-assessment evaluation by faculties, an external evaluation will be conducted.

・Procedure on giving feedback to students

In the case of problems with class subjects, faculties deal with these problems after taking into account the learning conditions of each individual student. The tutors or the Educational Improvement Committee members

handle matters comprehensively, which is reflected in the improvement of the program through discussions in the committee.

◎ Pcos gpcb qs hcar ncpgmb mdpcegprp rgml qncaqdgcb
○ Amk ns jqmpw cjcarqt c qs hcar l wmdrf cqc qs hcarq qf jj c pceggrcpcb
△ Dpcc cjcarqt c qs hcar l wmdrf cqc qs hcarq qf jj c pceggrcpcb

					nppgl e D jj /R R 1R 2R /R R 1R 2R /R R 1R 2R /R R 1R 2R
		Amk ns jqmpw cjcarqt c			○
qga Ans pqcq gl S l gf cpqgrw Cbs a rgml		Gl rpmbs arngml rmS l gt cpqgrw Cbs a rgml		Pcos gpcb	◎
		Gl rpmbs armpw ck gl p dmp Dgpqr Wc p rs bcl rq		Pcos gpcb	◎
	2	Ans pqcq gl prq l b Fs k l grgcq r nag j a			○ ○
	2	Ans pqcq gl L rs p j agcl acq			○ ○
		qga Cl e jgqf S q ec G	/	Pcos gpcb	◎ ◎
		qga Cl e jgqf S q ec GG	/		◎ ◎
Amk k ml s hcarq		Amk k s l ga rgml G	/		◎ ◎
		Amk k s l ga rgml G	/		◎ ◎
		Amk k s l ga rgml GG	/		◎ ◎
		Amk k s l ga rgml GG	/		◎ ◎
		/ qs hcarq dpmk qga j l es ec G	/		○
		/ qs hcarq dpmk qga j l es ec GG	/		○
		(L nrc 2) Cjck cl rq ml Gl dmpk rgml grcp aw mp Cvcpagqc gl Gl dmpk rgml grcp aw		Amk ns jqmp wcjcarqt c	○
Fc jrf l b nmprq Ans pqcq			/ mp	Amk ns jqmp wcjcarqt c	○ ○ ○ ○
		A jas js q G			◎
		A jas js q GG			◎
		gl c p jec p G			◎
		gl c p jec p GG			◎
		Ecl cp j Kcaf l gaq G			◎
		Ecl cp j Kcaf l gaq GG			◎
		Cvncpgk cl r j Kcrf mbq l b mo rmpw Umo gl Nf wosnoG	/		◎
		Cvncpgk cl r j Kcrf mbq l b mo rmpw Umo gl Nf wosnoGG	/		◎
		ck gl p gl qga K rf ck rgaq G	/		◎
		ck gl p gl qga K rf ck rgaq GG	/		○
		Cvncpgk cl r j Kcrf mbq l b mp rmpw Ump gl gminewG(L nrc 3)	/		○
		Cvncpgk cl r j Kcrf mbq l b mo rmpw Umo gl gminewGG	/		○
		qga Cjcarpmk el crgqk			○
		Dpmk jj s hcar Rwnc		Dpcc cjcarqt c	△ △ △ △ △ △ △ △

Cluster 3　Specialized Basic Subjects

◎Required

Class Subjects	Credits	Type of course registration: Applied Chemistry	Biotechnology	Chemical enneering	Class Hours/ Week: 1st grade Spring 1T	1st grade Spring 2T	1st grade Fall 3T	1st grade Fall 4T	2nd grade Spring 1T	2nd grade Spring 2	2nd grade Fall 3T	2nd grade Fall 4T	3rd grade Spring 1	3rd grade Spring 2	3rd grade Fall 3	3rd grade Fall 4	4th grade Spring 1	4th grade Spring 2	4th grade Fall 3	4th grade Fall 4	note
Applied Mathematics I	2	◎	◎	◎			4														
Applied Mathematics II	2	◎	◎	◎					4												
Applied Mathematics III	2													4							
Basic Engineering Computer Programming	2	◎	◎	◎					4												
Probability and Statistics	2												4								
Technical English	1	◎	◎	◎								4									
Basic Environmental Sciences	2						4														
Chemical Stoichiometry	2	◎	◎	◎						4											
Basic Organic Chemistry I	2	◎	◎	◎			4														
Basic Organic Chemistry II	2								4												
Physical Chemistry I	2	◎	◎	◎						4											
Biochemistry I	2	◎	◎	◎						4											
Basic Experiments in Chemistry	4	◎	◎	◎							#	#									
Basic Inorganic Chemistry	2	◎	◎	◎				4													
Analytical Chemistry	2	◎	◎	◎					4												
Basic life science	2						4														
Introduction to Applied Chemistry, Chemical Engineering and Biotechnology	2									4											
Introduction to Fundamental Industry	2									4											

◎Required subjects
○Compulsory Elective subjects

			1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T
Training of Biotechnology I	4	◎									12	12						
Experiments on Biotechnology II	4	◎											12	12				
MicrobiologyI	2	◎								4								
MicrobiologyII	2	◎										4						
Molecular biology I	2	◎								4								
Molecular biology II	2	◎										4						
Biochemistry II	2	◎							4									
BiochemistryIII	2	◎									4							
Enzyme Chemistry	2	○							4									
Bioorganic Chemistry	2	○									4							
Fermentation Technology	2	◎									4							
Biochemical Engineering	2	◎										4						
Glycotechnology & Immunotechnology	2	○												4				
Molecular BiologyIII																		

			区分														
	A																
	B																
	A																
	B																
	・Ⅱ																
	・Ⅱ																

			区分														

Curriculum Map of Biotechnology

Sheet

Academic Achievement Evaliation Items		1st grade		2nd grade		3rd grade		4th grade	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Knowledge and Understanding	Understanding of relations among human, society, nature, and engineering. (Target A)	Introductory Seminar for First-Year Students(◎)				FoodProcess Engineering I (△)	Food Process Engineering II(△)	Graduation Thesis(◎)	Graduation Thesis(◎)
		Introduction to University Education(◎)	Peace Science Courses(○)			Fermentation process engineeringII (△)	Fermentation Process Engineering III(△)	FermentationProcess Engineering I(△)	
		Area Courses (○)	Area Courses (○)				Group Discussion of Current Biotechnology Topics(◎)		
		Health and Sports Courses(○)	Health and Sports Courses(○)						
		Area Courses (○)	Area Courses(○)	Area Courses (○)	Area Courses (○)				
		Basic language I(○)	Basic Environmental Sciences(△)	Introduction to Applied Chemistry, Chemical Engineering and Biotechnology(△)					
		Basic language II(○)	Basic life science(△)	Introduction to Fundamental Industry(△)					
	Understanding of basic natural science (target B)	CalculusI(◎)	CalculusII(◎)	Experimental Methods and Laboratory Work in Physics I・Ⅱ(◎)					
		Linear AlgebraI (◎)	Linear AlgebraII(◎)						
		(2T)General Mechanics I(◎)	(3T)General Mechanics II(◎)						
		Seminar in Basic Mathematics I(○)	Seminar in Basic Mathematics II (○)						
			(4T)Basic Electromagnetism (○)						
	Acquisition of basic and advanced knowledge relating to biotechnology and life science. (Target/Lecture class)		Experimental Methods and Laboratory Work in Biology I・Ⅱ(△)		Technical English(◎)	Probability and Statistics (△)	Glycotechnology & Immunotechnology(○)		
		Basic Organic Chemistry I(◎)	Basic Organic Chemistry II(△)	Basic Engineering Computer Programming(◎)	Physical Chemistry II (△)	Applied Mathematics III (△)	Molecular BiologyIII(○)		
		Basic Inorganic Chemistry(◎)	Applied Mathematics I (◎)	Applied Mathematics II (◎)	MicrobiologyI (◎)	MicrobiologyII (◎)	Genetic and protein engineering(○)		
			Basic life science(△)	Physical Chemistry I(◎)	Molecular biology I (◎)	Molecular biology II (◎)	Molecular Bioinformatics(○)		
			Basic Environmental Sciences(△)	Chemical Stoichiometry(◎)	Biochemistry II (◎)	BiochemistryIII(◎)	Biotechnology(○)		
				Biochemistry I(◎)	Enzyme Chemistry (○)	Bioorganic Chemistry(○)	Advanced Organic Chemistry IV (△)		
				Analytical Chemistry(◎)	Chemical Engineering Fundamentals (○)	Fermentation Technology (◎)	Green Technology(△)		
				Introduction to Applied Chemistry, Chemical Engineering and Biotechnology(△)	Chemical Engineering Exercise I (○)	Biochemical Engineering(◎)	Recycling engineering (△)		
				Introduction to Fundamental Industry(△)		Chemical Kinetics (○)	Food Process Engineering II(△)		
						Organic Structural Analysis(△)	Fermentation Process Engineering III(△)		
						FoodProcess Engineering I (△)			
						Fermentation process engineeringII (△)			
Abilities and Skills	Acquisition of basic and advanced skills relating to biotechnology and life science. (Target/ Research class)		Experimental Methods and Laboratory Work in Biology I・Ⅱ(△)		Basic Experiments in Chemistry(◎)	Training of Biotechnology I(◎)	Experiments on Biotechnology II(◎)	Graduation Thesis(◎)	Graduation Thesis(◎)
Comprehensive Abilities	Cultivation of ability creating concept and solving problesms (achievement target D)	Introductory Seminar for First-Year Students(◎)	Experimental Methods and Laboratory Work in Biology I・Ⅱ(△)		Basic Experiments in Chemistry(◎)	Training of Biotechnology I(◎)	Experiments on Biotechnology II(◎)	Graduation Thesis(◎)	Graduation Thesis(◎)
							Group Discussion of Current Biotechnology Topics(◎)		
	Cultivation of communication skills (achievement target E)	Introductory Seminar for First-Year Students(◎)			Technical English(◎)	Training of Biotechnology I(◎)	Experiments on Biotechnology II (◎)	Graduation Thesis(◎)	Graduation Thesis(◎)
		Communication IA (◎)	Communication IIA (◎)				Group Discussion of Current Biotechnology Topics(◎)		
		Communication IB (◎)	Communication IIB(◎)						
		Basic English UsageI( )							
		Basic English UsageII( )							
		(1T)Information Courses(◎)							

(Ex) Liberal Arts Education Subjects | Basic Specialized Subjects | Specialized Subjects | Graduation Thesis

(◎)Required (○)Compulsory elective (△)Free elective